

WHAT IS CLAIMED IS:

1 1. A method of forming a ferroelectric PZT film on a substrate,
2 comprising:
3 providing a premixed source reagent solution comprising a mixture of a
4 lead precursor, a titanium precursor and a zirconium precursor in a solvent
5 medium;
6 vaporizing the source reagent solution to form a precursor vapor; and
7 introducing the precursor vapor into a chemical vapor deposition chamber
8 containing the substrate.

1 2. The method of claim 1, wherein the zirconium precursor comprises
2 $\text{Zr}(\text{OiPr})_2(\text{thd})_2$ or $\text{Zr}(\text{thd})_4$ or $\text{Zr}(\text{O}^i\text{Bu})_2(\text{thd})_2$.

1 3. The method of claim 1, wherein the lead precursor is
2 $\text{Pb}(\text{thd})_2(\text{pmdeta})$, the zirconium precursor is $\text{Zr}(\text{OiPr})_2(\text{thd})_2$, and the titanium
3 precursor is $\text{Ti}(\text{OiPr})_2(\text{thd})_2$.

1 4. The method of claim 1, wherein the lead precursor, the titanium
2 precursor and the zirconium precursor have a combined concentration between
3 about 0.05 M and about 1.0 M in solution.

1 5. The method of claim 1, wherein the source reagent solution is
2 characterized by lead, zirconium and titanium concentrations between about 5 %
3 and 95 %.

1 6. The method of claim 1, further comprising introducing into the
2 chemical vapor deposition chamber an oxidizing co-reactant gas comprising 5-
3 100 % N_2O .

1 7. The method of claim 6, wherein the oxidizing co-reactant gas
2 comprises 50-75 % N_2O .

1 8. The method of claim 1, further comprising introducing into the
2 chemical vapor deposition chamber an oxidizing co-reactant gas comprising one
3 or more of the following gases: N_2O , O_2 , and O_3 .

1 9. The method of claim 1, further comprising:
2 providing a second premixed source reagent solution comprising a second
3 mixture of the lead precursor, the titanium precursor and the zirconium precursor
4 in the solvent medium, wherein the first source reagent mixture is different from
5 the second source reagent mixture;
6 mixing the first and second reagent solutions to form a precursor solution;
7 and
8 vaporizing the precursor solution to form the precursor vapor.

1 10. The method of claim 9, wherein the first and second source reagent
2 solutions are characterized by a lead concentration in a range of about 28-65%, a
3 zirconium concentration in a range of about 14-29%, and a titanium
4 concentration in a range of about 20-43%.

1 11. The method of claim 1, wherein the solvent medium comprises an
2 octane-based solvent.

1 12. The method of claim 1, wherein the source reagent solution is
2 vaporized at a temperature in the range of about 180-210° C.

1 13. The method of claim 1, further comprising maintaining the chemical
2 vapor deposition chamber at a pressure in the range of about 0.5-10 torr during
3 deposition.

1 14. The method of claim 13, wherein the chemical vapor deposition
2 chamber is maintained at a pressure in the range of about 0.5-4 torr during
3 deposition.

1 15. The method of claim 14, wherein the chemical vapor deposition
2 chamber is maintained at a pressure of approximately 4 torr during deposition.

1 16. The method of claim 1, wherein the source reagent solution is
2 selected to obtain a precursor vapor having a Zr/(Zr + Ti) ratio in the range of
3 about 0.05-0.70.

1 17. The method of claim 1, wherein the source reagent solution is
2 selected to obtain a precursor vapor having a Pb/(Zr + Ti) ratio in the range of
3 about 0.3-3.0.

1 18. The method of claim 1, further comprising preheating the substrate
2 during a preheating period.

1 19. The method of claim 18, wherein the preheating period is about 5-
2 30 seconds long.

1 20. The method of claim 18, further comprising disposing the preheated
2 substrate on a heated susceptor during a heating period prior to formation of the
3 PZT film on the substrate.

1 21. The method of claim 20, wherein the heating period is about 30-60
2 seconds long or longer.

1 22. The method of claim 1, further comprising providing a flow of a
2 purge gas to reduce film depositions on susceptor and chamber wall surfaces.

1 23. A method of forming a ferroelectric PZT film on a substrate,
2 comprising:

3 introducing a substrate into a chemical vapor deposition chamber;

4 preheating the substrate during a preheating period;

5 after the preheating period, disposing the substrate on a heated susceptor
6 during a heating period;

7 forming a precursor solution from a mixture of a lead precursor, a titanium
8 precursor and a zirconium precursor in a solvent medium;

9 vaporizing the precursor solution to form a precursor vapor; and

10 introducing the precursor vapor into the chemical vapor deposition
11 chamber to form a ferroelectric PZT film on the heated substrate.

1 24. The method of claim 23, wherein the substrate is preheated by
2 supporting the substrate above the heated susceptor during the preheating period.

1 25. The method of claim 23, further comprising providing a flow of a
2 purge gas to reduce film depositions on susceptor and chamber wall surfaces.